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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/925,366	08/10/2001	Thomas Gilbert Halvorson	D-20814	4461

27182 7590 01/25/2005

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EXAMINER	
RIDLEY, BASIA ANNA	

ART UNIT	PAPER NUMBER
1764	

DATE MAILED: 01/25/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

4R

Office Action Summary	Application No.	Applicant(s)	
	09/925,366	HALVORSON ET AL.	
	Examiner	Art Unit	
	Basia Ridley	1764	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 November 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13* is/are pending in the application.

4a) Of the above claim(s) *9,10 and 13* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-8,11 and 12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07 July 2002* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *110104*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Information Disclosure Statement

1. All the documents cited in the information disclosure statement filed on 1 November 2004 have been already submitted and considered as part of the information disclosure statement filed on 10 August 2001.

Drawings

2. The drawings filed on 07 June 2002 are objected to for the following reasons:

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because Fig. 1 does not include reference character(s) "52" mentioned in the description: see [0053], line 13.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because Fig. 1 includes reference character "5" not mentioned in the description.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because Fig. 1 does not include reference character(s) "80" or "88" mentioned in the description: see amended [0073], line 3-4.

Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the

applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

3. Claim 6 is objected to because of the following informalities: "their said open ends" in line 3 of said claim should be replaced with --said open ends--. Appropriate correction is required.

Claim Rejections - 35 USC § 103

4. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

5. Claims 1-3, 5-8 and 11-12 are is rejected under 35 U.S.C. 103(a) as being unpatentable over Gottzmann et al. (USP 5,820,655) in view of Nataraj et al. (USP 6,048,472).

Regarding claim 1, Gottzmann et al.'655, in Fig. 1-2, discloses an apparatus for the production of synthesis gas including:

- a reaction vessel (14);
- a first heat exchanger, located within one end of said reaction vessel, to heat a preheated oxygen containing stream by indirect heat exchange with an oxygen depleted stream (Fig. 2);
- a second heat exchanger, located within the other end of said reaction vessel, to heat a reactant stream by indirect heat exchange with a product stream (Fig. 2);
- a plurality of oxygen transport membranes (28) located in a reaction section of the reaction vessel (14) to separate oxygen from the oxygen containing stream, thereby to produce permeated oxygen at anode sides of the oxygen transport membrane tubes (Fig. 2);
- the oxygen transport membranes having cathode sides in communication with the first heat exchanger to receive the oxygen containing stream (Fig. 2);
- the reaction section (29) in communication with the second heat exchanger so that the reactant

stream is introduced to the anode side of oxygen transport membranes in said reaction section (Fig. 2);

- a catalyst located within the reaction section to promote the reaction of the permeated oxygen to produce the synthesis gas product stream (C2/L5-7 and C4/L1-20);

- first entrant and discharge passages in communication with the first heat exchanger to allow for passage of the oxygen containing and oxygen depleted streams, respectively, to and from the reactor vessel (Fig. 2);

- second entrant and discharge passages in communication with the second heat exchanger to allow for passage of the reactant and synthesis gas product streams, respectively, to and from the reactor vessel (Fig. 2); wherein

- the first heat exchanger, the second heat exchanger, and the oxygen transport membrane tubes are each supported within the reactor vessel independently of one another so that each can independently expand or contract (Fig. 2).

While Gottzmann et al.'655 discloses a catalyst present as porous layers located within the reaction section (see C2/L5-7 and C4/L1-20), the reference does not explicitly disclose said catalyst being present as a catalyst bed.

Nataraj et al. (C2/L66-C3/L16) establishes equivalency of catalyst applied as porous layer and of catalyst bed, which can be used alternatively or in combination. As instant specification is silent to unexpected results, it would have been obvious to one of ordinary skill in the art at the time of the invention to substitute the catalyst layers of Gottzmann et al.'655 with catalyst bed, since such modification would have involved a mere substitution of known equivalent structures. A substitution of known equivalent structures is generally recognized as being within the level of ordinary skill in the art.

Regarding claims 2-3, 5-7 and 11-12, Gottzmann et al.'655 in view of Nataraj et al., disclose all of the claim limitations as set forth above. Additionally Gottzmann et al.'655 discloses the apparatus wherein:

- said reactant section has baffle plates configured to produce a flow of the reactant gas through the reactant section and therefore the catalyst bed of one of: axial flow, cross-flow, combined axial and transverse flow; spiral flow; radially-segmented cross-flow; and transverse-segmented cross-flow (Fig. 3A and C11/L25-42);
- said oxygen transport membranes (28) are tubular and said reactant section has perforated shroud tubes (38) surrounding said oxygen transport membrane tubes (28);
- wherein each of the first and second heat exchangers has a heat exchanger tubesheet (27) connected to the reactor vessel and a plurality of tubes connected to said tubesheet for internal passage of said product stream and said oxygen containing stream, respectively (Fig. 2);
- said oxygen transport membranes (28) are of tubular configuration having closed and open ends and are supported at said open ends from a support tubesheet (27) located between the heat exchanger tubesheets (Fig. 2);
- said tubes divide said first and second heat exchangers into oxygen containing gas feed and oxygen depleted gas and feed gas and product gas sides, on opposite sides of said tubes, respectively (Fig. 2);
- each of the oxygen transport ceramic membranes is of tubular configuration and of composite construction and has a porous support layer located on the anode side and an adjacent dense membrane film located on the cathode side thereof (C7/L1-7);
- a reforming catalyst of said catalyst bed is located in an outer portion of said porous support layer (Fig. 3A and C11/L25-42).

Regarding claim 8, Gottzmann et al.'655 in view of Nataraj et al., disclose all of the claim limitations as set forth above. While Gottzmann et al.'655 does not explicitly disclose an apparatus wherein said second heat exchanger has first and second stages with a catalytic pre-reforming section located between said stages containing a pre-reforming catalyst, Nataraj et al. teaches that in a reactor comprising

- a reaction vessel (C6/L3-46);
- a first heat exchanger, to heat a preheated oxygen containing stream (C6/L3-46);
- a second heat exchanger, to heat a reactant stream (C6/L3-46);
- a plurality of oxygen transport membranes located in a reaction section to separate oxygen from the oxygen containing stream (C6/L3-46);
- the reaction section in communication with the second heat exchanger so that the reactant stream is introduced to the reaction section (C6/L3-46);
- a catalyst located within the reaction section to promote the reaction of the permeated oxygen to produce the synthesis gas product stream (C6/L3-46).

Further Nataraj et al. teaches that said second heat exchanger has first and second stages with a catalytic pre-reforming section located between said stages containing a pre-reforming catalyst (C6/L3-46). Said staged reforming offers a more efficient apparatus with upgraded performance (C2/L1/16).

It would have been obvious to one having ordinary skill in the art at the time of the invention to divide the second heat exchanger of Gottzmann et al.'655 into first and second stages with a catalytic pre-reforming section located between said stages, as taught by Nataraj et al., for the purpose of providing a more efficient apparatus with upgraded performance.

Regarding limitations recited in claims 1-3, 5-8 and 11-12 which are directed to a manner of operating disclosed reactor, the examiner notes that neither the manner of operating a disclosed device nor material or article worked upon further limit an apparatus claim. Said limitations do not differentiate apparatus claims from prior art. See MPEP § 2114 and 2115. Further the examiner notes that process limitations do not have patentable weight in an apparatus claim. See *Ex parte Thibault*, 164 USPQ 666, 667 (Bd. App. 1969) that states "Expressions relating the apparatus to contents thereof and to an intended operation are of no significance in determining patentability of the apparatus claim."

6. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Gottzmann et al. (USP 5,820,655) in view of Nataraj et al. (USP 6,048,472), as applied to claim 1 above, and further in view of Gottzmann et al. (USP 6,139,810).

Regarding claim 4, Gottzmann et al.'655 in view of Nataraj et al. discloses all of the claim limitations as set forth above, but the references do not disclose the reactor further comprising an inert buffer gas zone located between the reaction section and seal locations at the open ends of the oxygen transport membrane tubes.

Gottzmann et al.'810 teaches an improved reactor wherein presence of an inert buffer gas zone located between the reaction section and seal locations at the open ends of the oxygen transport membrane tubes to allow introduction of a non-reactive gas therein at a pressure greater than that of the reactant zone to prevent leakage of reactant gas from the reactant stream into the oxygen containing stream (C10/L18-49).

It would have been obvious to one having ordinary skill in the art at the time of the invention to add the inert buffer gas zone located between the reaction section and seal locations at the open ends of the oxygen transport membrane tubes in the reactor of Gottzmann et al.'655, as

taught by Gottzmann et al.'810, for the purpose of improving reactor safety by allowing introduction of a non-reactive gas to prevent leakage of reactant gas from the reactant stream into the oxygen containing stream.

Regarding limitations recited in claim 4 which are directed to a manner of operating disclosed reactor, the examiner notes that neither the manner of operating a disclosed device nor material or article worked upon further limit an apparatus claim. Said limitations do not differentiate apparatus claims from prior art. See MPEP § 2114 and 2115. Further the examiner notes that process limitations do not have patentable weight in an apparatus claim. See *Ex parte Thibault*, 164 USPQ 666, 667 (Bd. App. 1969) that states "Expressions relating the apparatus to contents thereof and to an intended operation are of no significance in determining patentability of the apparatus claim."

7. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

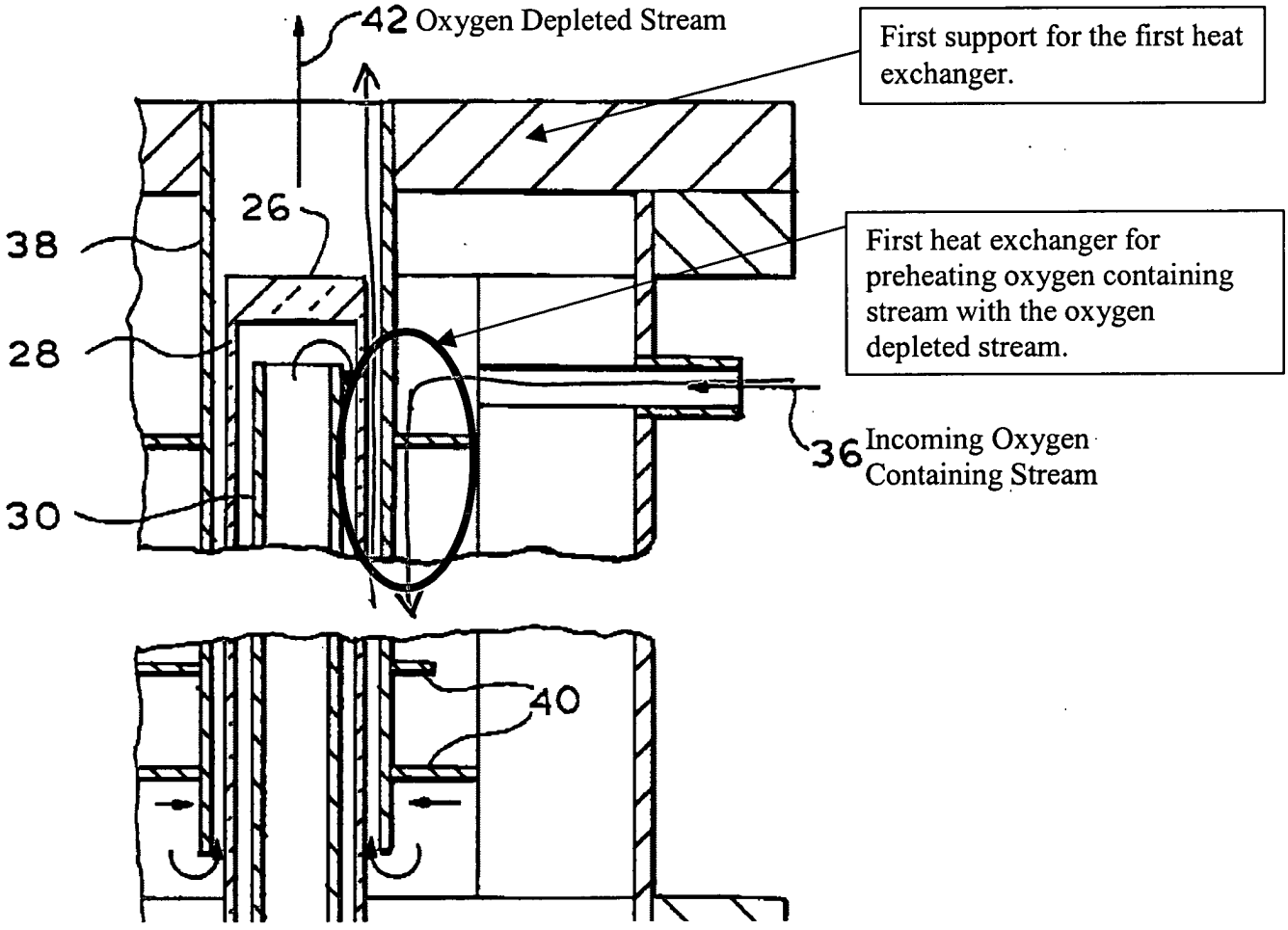
Response to Arguments

8. Applicant's arguments filed 1 November 2004 have been fully considered but they are not persuasive.

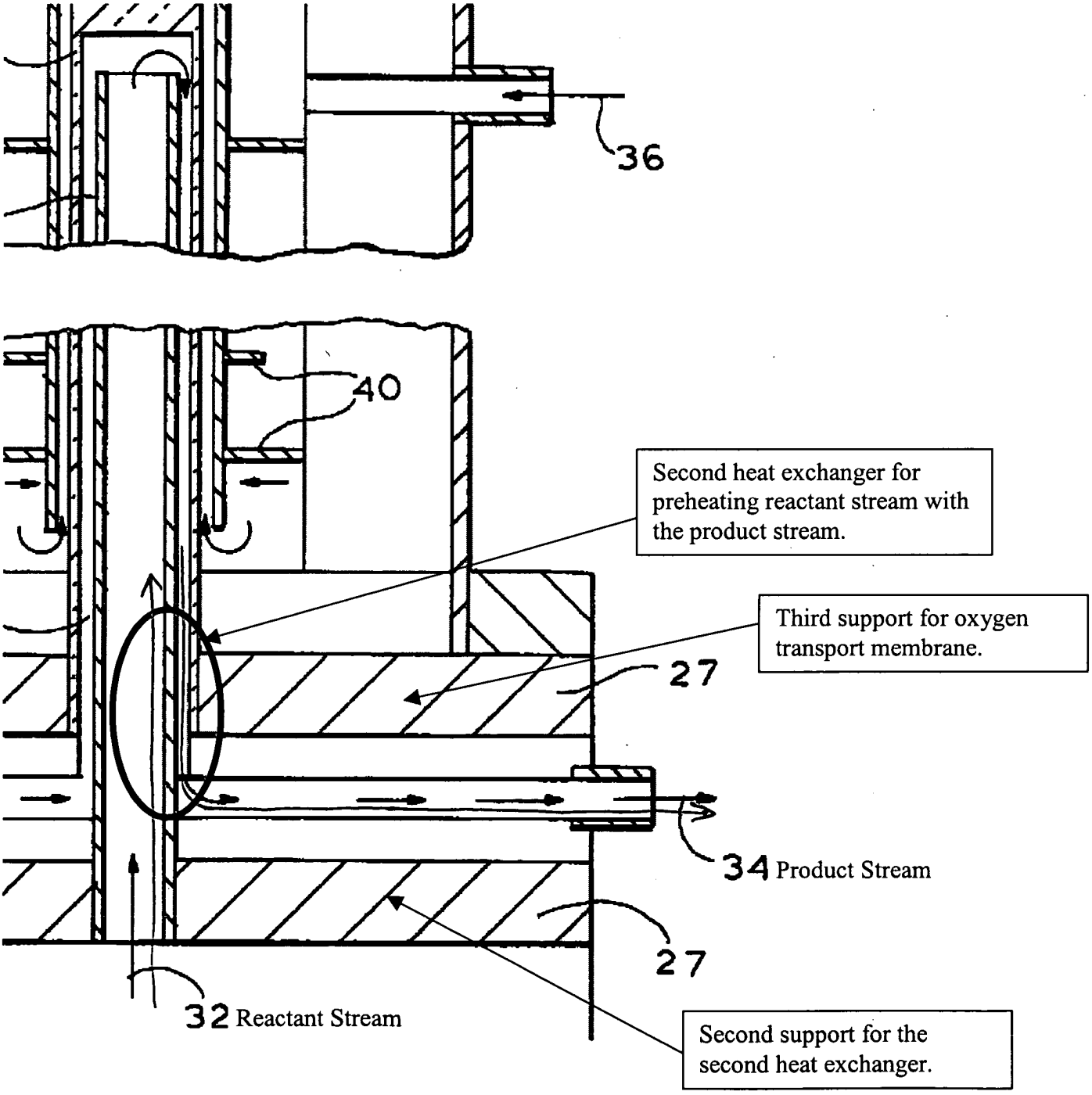
9. The applicant argues that Gottzmann et al.'655 does not have the heat exchangers of the present invention or their independent supports. This is not found persuasive. Gottzmann et al.'655

in Fig. 2 clearly shows two heat exchangers as recited in instant claims which are independently supported. To clarify examiner's position, the following are partial copies of Fig. 2 with additional annotations.

The following figure shows the first heat exchanger of Gottzmann et al.'655 for preheating oxygen containing stream by indirect heat exchange with the oxygen depleted stream. The flow of oxygen containing stream is shown by green line and the flow of oxygen depleted stream is shown by purple line.



The next figure shows the second heat exchanger of Gottzmann et al.'655 for heating a reactant stream comprising at least one hydrocarbon and steam by indirect heat exchange with a synthesis gas product stream. stream. The flow of reactant stream is shown by blue line and the flow of product stream is shown by orange line.



Further, Gottzmann et al.'655 clearly discloses that there is very efficient heat transfer between gases in various annular passages (see column 8, line 66 to column 9, line 9). While that specific passage refers to Fig. 1, the same comments apply to Fig. 2 (see column 11, lines 7-9 which discloses that "Flow of oxygen-containing gas stream 36 in Fig. 2 is identical to that of Fig. 1 as are the reaction, heat transfer, and gas flow relationships.").

Conclusion

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to examiner Basia Ridley, whose telephone number is (571) 272-1453.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola, can be reached on (571) 272-1444.

The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Technical Center 1700 General Information Telephone No. is (571) 272-1700. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-

direct.uspto.gov. Questions on access to the Private PAIR system should be directed to the Electronic Business Center (EBC) at (866) 217-9197 (toll-free).

Basia Ridley
Examiner
Art Unit 1764

BR
January 21, 2005